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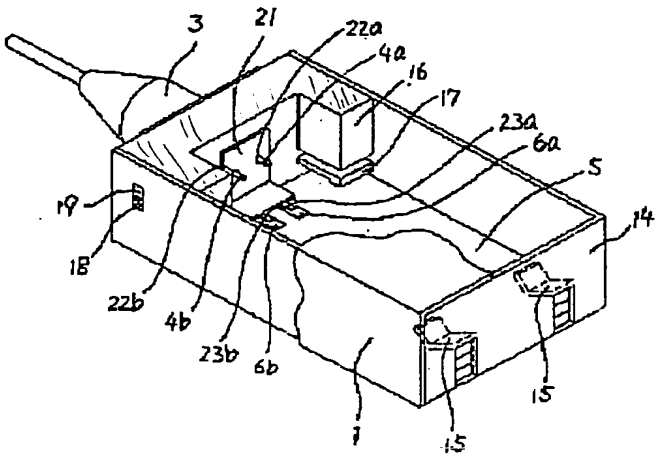
TITLE : OPTICAL TRANSMITTER-RECEIVER AND ITS ASSEMBLY METHOD



ABSTRACT : PROBLEM TO BE SOLVED: To provide an optical transmitter-receiver at a low cost by abandoning the use of an adhesive material and a screw kind, shortening assembly work time and reducing man-hour for the holding to a case of a substrate for an electronic circuit and abandoning the need of a lead forming jig, shortening the assembly work time and reducing the man-hour for the electrical connection of an optical semiconductor module and the substrate for the electronic circuit.

SOLUTION: The substrate 5 for the electronic circuit is inserted and held between a pawl 15 for which a part of the case 14 is deformed and worked and the projection 17 in a thin plate shape of a block 16 and a case bottom surface. Further, the lead terminals 4 (4a and 4b) of the optical semiconductor module 3 are inserted to holes 22 (22a and 22b) provided on the block 16 and the optical semiconductor module 3 and the substrate 5 for the electronic circuit are electrically connected by using a flexible substrate 21.

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[0004]
[Problems to be Solved by the Invention]

Prior art optical transmitters/receivers generally have a configuration as described above. However, in the example shown in Figs. 7 and 8, there is a problem that, in fixing an electronic circuit substrate 5 to a casing 2, a great number of process steps are required for keeping, applying, and hardening an adhesive 8, which results in increase in cost. Further, for electrical connection between an optical semiconductor module 3 and the electronic circuit substrate 5, many process steps are required for soldering lead terminals 4a, 4b to wires 7a, 7b, and for forming the lead terminals and the wires 7a, 7b in a shape which facilitates positioning and soldering the wires 7a, 7b to lands 6a, 6b, as well as for design, distribution and maintenance of associated jigs, which also increases cost. Also, there is another problem that heat transmitted between the optical semiconductor module 3 and the electronic circuit substrate 5 affects the electrical characteristics, as no structure is provided for heat insulation between these two elements.

[0005]

Further, in the example shown in Figs. 9 and 10, there is a problem that, in fixing an electronic circuit substrate 10 to a casing 9 having bosses, many process steps are required for keeping and screwing a bolt 12 used for a boss, which results in increase of cost. Further, for electrical connection between an optical semiconductor module 3 and the electronic circuit substrate 10, many process steps are required for forming lead terminals 4a, 4b in a shape which facilitates positioning and soldering the lead terminals 4a, 4b to through holes 11a, 11b and for design, distribution and maintenance of associated jigs, which also increases cost. Also, there is another problem that heat transmitted between the optical semiconductor module 3 and the electronic circuit substrate 10 affects the electrical characteristics, as no structure is provided for heat insulation between these two elements.

[0006]

The present invention was made so as to solve the foregoing problems of the related art. One object of the present invention is to shorten the time required for assembly operations and the number of process steps required for fixing an electronic circuit substrate to a casing by eliminating the use of adhesives and bolts or the like and utilizing elasticity and rigidity of a claw provided on a casing and elasticity and rigidity of a block. Another object of the present invention is to eliminate the necessity of a lead forming jig, shorten

the time required for assembly operation, reduce the number of process steps, and therefore obtain a low cost optical transmitter/receiver, by forming the lead terminals of the optical semiconductor module by using a block and electrically connecting the lead terminals and the electronic circuit substrate using a flexible substrate in electrically connecting the optical semiconductor module and the electronic circuit substrate. Still another object of the present invention is to thermally insulate the optical semiconductor module and the electronic circuit substrate when a heat insulating material is used for the block, thereby eliminating the influence of heat transmitted therebetween onto the electrical characteristics.

[0009]
[Embodiment of the Invention]
Embodiment 1:

Fig. 1 illustrate an outer appearance of an optical transmitter/receiver and a assembling method thereof; Fig. 2 is an exploded view of Fig. 2; and Figs. 3 to 6 respectively show the assembling procedure. In these drawings, elements 1, 3, 4a, 4b, 5, 6a, and 6b are identical to the corresponding structures in the related art described above. Numeral 14 denotes a casing. Numeral 15 denotes a claw formed by bending a side surface or a continuous portion of side and bottom surfaces of the casing 14 toward the interior of the casing 14 so as to form an elbow shape. An electronic circuit substrate 5 is sandwiched between the claw 15 and the bottom surface of the casing 14. Numerals 16 and 17 denote a block and a thin plate protrusion formed on the block, respectively. The electronic circuit substrate 5 is held between the thin plate protrusion 17 and the bottom surface of the casing 14. Numeral 18 denotes an opening or a convex portion formed in the casing, and numeral 19 denotes an opening or a convex portion formed on each of two opposing side surfaces of the block 16. The opening or convex portion 18 and the opening or convex portion 19 engage with each other. Numerals 20a and 20b are openings in the block, into which the lead terminals 4a and 4b are individually inserted. Numeral 21 denotes a flexible substrate having openings 22a and 22b. After inserting the lead terminals 4a and 4b individually into the openings 22a and 22b of the flexible substrate, soldering of the lead terminal 4a to the opening 22a of the flexible substrate and soldering of the lead terminal 4b to the opening 22b of the flexible substrate are performed. Numerals 23a and 23b denote terminals of the flexible substrate 21, which are connected to the lands 6a and 6b, respectively.

[0010]

The assembly procedure will be described. In process 1,

as shown in Fig. 3, the electronic circuit substrate 5 is sandwiched between the claws 15 formed on the side surface of the casing 14 and the bottom surface of the casing 14. In process 2, as shown in Fig. 4, a plurality of lead terminals 4a, 4b of the optical semiconductor module 3 which have the respective electrical polarities are inserted into a plurality of openings 20a, 20b formed in the block 16, and then the optical semiconductor module 3 and the block 16 are connected. In process 3, as shown in Fig. 5, the plurality of lead terminals 4a, 4b are inserted into a plurality of openings 22a, 22b formed in the flexible substrate 21, and then soldering is applied to this inserted portion. In process 4, as shown in Fig. 6, the assemblies obtained by the above processes 2 and 3 are mounted onto the casing 14 in such a manner that the convex portion or opening 19 formed on the side surface of the block 16 fits the opening or convex portion 18 formed on the side surface of the casing 14. Simultaneously, the electronic circuit substrate 5 is placed between the thin plate protrusion 17 formed on the block 16 and the bottom surface of the casing 14. Further, a plurality of terminals 23a, 23b formed on the flexible substrate 21 and a plurality of lands or through holes 6a, 6b of the electronic circuit substrate 5 are fixed by soldering. Finally, a cover 1 is placed to cover the casing 14 to complete the assemble shown in Fig. 1.

[0011]

According to the optical transmitter/receiver of the present invention thus configured, the elasticity and rigidity of the claw 15 and of the thin plate protrusion 17 are used to hold the electronic circuit substrate 5 onto the casing 14. Further, lead forming is achieved by inserting the lead terminals 4a, 4b into the openings 20a, 20b of the block, respectively. Also, when a heat insulating material is used for the block 156, heat insulation is provided between the optical semiconductor module 3 and the electronic circuit substrate 5. In addition, the optical semiconductor module 3 is electrically connected to the electronic circuit substrate 5 via the flexible substrate 21.